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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/690,507

10/23/2003

Ji Yong Park

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EXAMINER

SONG, MATTHEW J

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

11/26/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/690,507

Applicant(s)

PARK ET AL.

Examiner

Matthew J. Song

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 13 September 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3,6-8,10,13 and 14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,6-8,10,13 and 14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 3 and 13-14 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Jung (US 6,825,493).

Jung discloses a method of forming an amorphous silicon layer on a substrate and crystallizing the amorphous layer to form polycrystalline silicon (col 14, ln 35-67). Jung also discloses the crystallization method comprises irradiating the amorphous silicon layer **200** with a laser beam **34** that passes through a mask **130** (col 9, ln 1-67 and Fig 6a). The mask is then moved along the lateral grain growth of the grains by a distances of about 0.7 micrometers; therefore each of the light transmitting portions of the mask exposes a portion of the first grain region, middle section, the second grain regain and an new amorphous silicon regions are additionally exposed resulting in larger grains (col 9, ln 45-67), this reads on applicant's the laser beam is overlappingly irradiated at an overlapping region on the substrate where amorphous silicon and a part of the already crystallized polysilicon are exposed so as to increase an average width of the polycrystalline silicon grains. Jung also teaches the width of the overlap corresponds

to movement of the mask, which is varied between 0.7 micrometers and 1.7 micrometers (col 9, ln 45-67; col 10, ln 25-45; and col 14, ln 1-25). Jung teaches silicon grains have a width of 12 micrometers (col 10, ln 1-15) and have a grain width of 1.7 micrometers when the overlap is decreased (col 10, ln 1-65).

Referring to the limitation, “wherein the average width of the polycrystalline silicon grains is varied between approximately 0.2 and 0.6  $\mu\text{m}$  and is decreased when the width of the overlapping region on which the laser beam is overlapping irradiated is decreased”, Jung teaches the width of the overlap corresponds to movement of the mask, which is varied between 0.7 micrometers and 1.7 micrometers (col 9, ln 45-67; col 10, ln 25-45; and col 14, ln 1-25). Also, the width of the grains is also between 0.2 and 0.6  $\mu\text{m}$  based Fig 3C which shows the grains and has a 0.7  $\mu\text{m}$  reference scale and the width between the grains. Furthermore, Jung teaches decreasing the width of the overlap, thus the average width of the grains will decrease because applicant’s teach decreasing the width by decreasing the overlap, note paragraph [0028] of the original specification; therefore a similar grain width is inherent because Jung discloses an overlap within the range taught by applicant to obtain the claimed grain width. While Jung does disclose a grain width within the claimed range in Fig 3C, Jung does not state in the specification what the width is but rather the width can be determined from the figure. In the alternative that Jung does not teach the claimed width, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Jung by varying the overlap to obtain the claimed width.

Referring to claim 3, Jung teaches sequential lateral solidification crystallization (Abstract).

Referring to claim 13-14, Jung discloses irradiating an amorphous silicon film using a laser beam through a mask with a light transmission region and a light non-transmission region; transversely moving the mask; overlappingly irradiating the already formed crystalline silicon and has a width of 0.7  $\mu\text{m}$  to 1.7  $\mu\text{m}$  (col 9, ln 1 to col 10, ln 65).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 6-8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jung (US 6,825,493) as applied to claims 1, 3 and 13-14 above, and further in view of Yang (US 2002/0197759 A1).

Jung discloses all of the limitations of claim 6, as discussed previously, except Jung does not teach the laser transmission region is wider than the laser non-transmission region by more than 1  $\mu\text{m}$ .

In a method of sequential laser solidification (SLS) for crystallization of amorphous silicon, note entire reference, Yang teaches the mask moves transversely by no more than the wide of the shaped patterns as a laser performs SLS crystallization. (Abstract). Yang also teaches a mask includes a plurality of slits A that pass a laser beam and a light absorptive areas B that absorb the laser beam and the wide of each slit A defines the grain size of the crystallized silicon ([0010]). Yang also teaches using a pattern of 2  $\mu\text{m}$  ([0072]) and grains of 1-1.5  $\mu\text{m}$  ([0076]). Yang also teaches an overlapped regions ([0040]). Yang also teaches more rapid crystallization can be achieved using masks having different slit patterns and laser beam scanning ([0035]). Yang also teaches a pattern where the slit patterns are wider than an interval "O". (Fig 6 and [0035]).

Yang teaches using different patterns and a pattern where the laser transmission region is larger than a non-transmission regions. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Jung by having a transmission region that is wider than a non-transmission region by more an 1  $\mu\text{m}$  by optimizing the mask size because the size of the slit is a result effective and different patterns are used to achieve more rapid crystallization, as taught by Yang.

Referring to claim 7, the combination of Jung and Yang teaches stripes ('493 Fig 5 and '759 Fig 6).

Referring to claims 8 and 10, the limitations are the same as claims 1-3 which was discussed previously.

***Response to Arguments***

5. Applicant's arguments filed 9/13/2007 have been fully considered but they are not persuasive.

Applicant's argument that Jung does not teach the average width of the polycrystalline silicon grains is varied between approximately 0.2-0.6  $\mu\text{m}$ . The Examiner discussed this feature on page 4 of the previous office action. Summarizing the argument again, Jung teaches moving the mask by a distance of 0.7 and 1.7  $\mu\text{m}$  (col 9, ln 50-60 and col 10, ln 30-50) and this corresponds to the regions which are already exposed, this reads on applicant's width of the overlapping region corresponds to the distance and is varied between 0.5-2  $\mu\text{m}$ . Thus Jung anticipates the claimed range. Also, varying the width of overlap would have been obvious to one of ordinary skill in the art because Jung teaches adjusting the mask movement distance (col 14, ln 10-30), which corresponds to the width of the overlap region.

Applicant's argument that Jung does not anticipate or render obvious an average width of the polycrystalline grains is varied between approximately 0.2-0.6  $\mu\text{m}$ . First, it is necessary to distinguish the "width" of the grains from the "width" taught by Jung. Applicant teaches the width is the horizontal distance between the triangular shaped grains, See Figure 1B. However, Jung teaches the "width" S to the vertical length rather than the distance between the triangular portions, See Figure 9E. Comparing applicant's Figure 1B and Jung's Figure 9E, the definition of width is not the same. Thus when Jung discusses "width" being 12  $\mu\text{m}$ , that is not a teaching of

"width" outside the claimed range. Second, it is the Examiner's position that Jung's Figure 3C which teaches shows grains and a provides a  $0.7\ \mu\text{m}$  shows grain widths within the claimed range. Also, Jung teaches a irradiating a substrate with a mask and a similar overlap of grains, used by applicant to achieve the claimed grain width; therefore a similar method is expected to produce grains with similar widths. Finally, the Examiner provided in the alternative that the claimed grain widths would have been obvious to one of ordinary skill in the art.

Applicant's arguments in regards to the limitation, average width is decreased when the width of the overlapping region on the laser beam is decreased is noted but not found persuasive. Applicant alleges that Jung does not teach decreasing the width of the overlap. Jung teaches a mask movement of  $0.7$  and a movement of  $1.7\ \mu\text{m}$  (col 9, 50-67 and col 10, ln 30-40) and adjusting the mask movement distance (col 14, ln 10-20), thus the width of the overlap decreases because the movement distance changed. The decreasing of the average width of the grain limitation is merely a claimed effect of varying the amount of overlap, thus is taught Jung.

Applicant's argument that Yang does not teach or suggest a mask with a laser transmission region is wider than a laser non-transmission region by more than  $1\ \mu\text{m}$  is noted but not found persuasive. Yang clearly teaches using different patterns for SLS crystallization ([0035]). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Jung by using a mask with the claimed features because the slit size is a result effective variable which can be optimized through routine experimentation. Applicant alleges that the masks taught by Yang are very different from the claimed mask, however the masks taught by Yang suggest the broadly claimed mask which merely requires a light transmission portion is larger than a non-transmission portion by more than  $1\ \mu\text{m}$ . Yang teaches



a SLS formation using improved masks which result in improved grain growth control and a high quality polycrystalline Si (Abstract), thus the combination would have been obvious to one of ordinary skill in the art at the time of the invention.

### ***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on 571-272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Matthew J Song  
Examiner  
Art Unit 1792

MJS  
November 19, 2007

*/Robert Kunemund/  
Robert Kunemund  
Primary Examiner  
TC 1700*